

Does Corporate Environmental Investment Impede Financial Performance of Chinese Enterprises? The Moderating Role of Financial Constraints

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Abstract

China has emerged as the world's largest pollutant emitter due to rapid industrialization and a remarkable economic upsurge in recent decades. Rising carbon emissions have exerted more social and regulatory pressure on Chinese corporations to undertake environmental protection investments. However, the implications of such investments on the financial fundamentals of a firm remain unclear. Especially little is known about how environmental protection investments affect the performance of financially constrained firms. This study explores the mediating role of financial constraints in the nexus between corporate environmental protection investment and the accounting and market performance of Chinese listed firms during 2009–2016. The empirical outcomes of the generalized method of moments (GMM) based regressions reveal that environmental investments of non-constrained firms have a positive impact on the accounting and market performance of such firms measured by ROA and Tobin's q respectively. Interestingly, environmental protection investments have a significant negative association with both the accounting and market performance proxies of firms that are facing financial constraints. These findings imply that in pursuit of environment preservation and pollution abatement, policymakers shall provide more financial flexibility and enabling environment to financially constrained firms to optimize their role in pollution abatement.

1. Introduction

Rapid industrialization has generally ignored the biophysical impact on the environment of a wide range of activities of private sector firms. Consequent economic growth and socio-economic transformation resulted in increased greenhouse gas (GHG) emissions and environmental degradation especially in the case of China (Tian and Lin, 2019). Increased Carbon emissions substantially escalate public health expenditures and deteriorate the quality of life in a country (Akbar et al., 2020, b). In 2013, the CO₂ emissions in China had reached 10 billion tons which were higher than the carbon emitted by both US and EU took together (Friedlingstein et al., 2014). The hazardous environmental quality and consequent health problems and quality of life have caused serious concerns and discontent among the general public forcing the Chinese government to enact policy measures for pollution abatement (Tong et al., 2016). The environmental quality and government spending on the environment significantly influence life expectancy in China (Shah et al., 2020). The World Health Organization notes that the human cost of air pollution in China is enormous linked to 1.2 million premature deaths in 2010. While in the same year, the financial cost of environmental degradation was estimated to be \$230 billion or 3.5% of China's total GDP (Wong, 2013). Therefore, going forward, it is indispensable to balance the economic advancement with environmental preservation for sustainable development in China.

Since its policy of reforms and opening up in 1978, China has experienced phenomenal economic growth. It is the world's second-largest economy (Wu, 2015), and the world's largest trading country. However, this fast-paced economic development and rapid industrialization have also led China to be the world's biggest pollutant emitter (Li et al., 2016), confronted with the challenge to sustain its economic growth at the same time to innovate green and environment-friendly technologies for pollution abatement. Moreover, consequent to the recent US pullout from the Paris agreement on climate change the world expects China to assume a global leadership role in the conservation of the environment.

The corporate sector is a major source of energy consumption and pollution emissions in an economy. In recent years, the Chinese government has rolled out strict policy measures and mandated the firms to deploy financial resources for environmental protection, greener production, and pollution abatement (Yang et al., 2019; Jiang & Akbar, 2018). Consequently, Chinese firms feel compelled to comply with relatively stricter environmental regulations. Chinese firms are still in the infancy stage of their environmental practices, and hence they only undertake environmental activities in response to the regulatory pressure (He et al., 2016). An environmental inspection of Beijing and surrounding provinces indicated that around 78 percent of firms failed to comply with the relevant laws and regulations pertaining to environmental preservation (MEP, 2017). The Chinese government has enacted various regulations concerning corporate environmental responsibility. For instance, in 2008, the Chinese Ministry of Environmental Protection (MEP) made it mandatory for the heavily polluting industries to publish information on their environmental performance. In 2010, Shanghai Stock Exchange published the guide to the environmental disclosures by listed firms, thus requiring firms to undertake environmental responsibility. In 2015, the Chinese government enforced the most stringent corporate environmental regulations subjecting law-breaking firms to fines and even jail terms. Such authoritarian regulations may lead to an increased cost of doing business. However, this may not lead to a sustainable path of environmental conservation. Firms have limited financial resources to be allocated to a wide range of investment avenues (Akbar et al., 2020, a). The corporate sector will only be willing to make the environmental investment for pollution abatement if it helps reduce their costs across the value chain to improve corporate financial performance (CFP) (Porter & Linde, 1995). From the legal and cultural perspective, the prevailing institutional environment has a positive impact on corporate environmental investment (Han et al., 2020). Therefore, we argue that at a policy level along with their current stringent regulatory framework the regulators in China need to integrate corporate environmental performance into corporate financial performance so that the Chinese firms voluntarily make environmental investments for sustainable production to help conserve the environment as well as create value for their stakeholders including their shareholders.

The contribution of this research is two-fold. First, we make use of manually collected data of Chinese listed firm's environmental investments to uncover the association between such investments and a firms' accounting and market performance. Furthermore, keeping in view financially constrained firms find it difficult to spare funds for corporate social responsibility undertakings, we segregate our data into financially constrained and non-constrained firms to observe the proposed association in each group. Second, we estimate our models using a superior econometric technique called two-step system GMM regression to address the issues of unobserved heterogeneity, endogeneity, and heteroskedasticity that can be present in the panel data.

There are five sections in the study. After the introduction in Sect. 1, Sect. 2 presents the theoretical framework and develops the hypotheses for the study. Section 3 presents the empirical model, describes the methodology and the data. Section 4 presents and discusses the results, and Sect. 5 provides conclusions and policy implications. The references are at the end.

2. Theoretical Framework And Hypotheses Development

Perhaps the pioneer proposition on the effects of corporate environmental performance on CFP is the trade-off theory which dates back to the neoclassical scholars (Friedman, 1970, Wright and Ferris, 1997). They accentuate that the sole reason for the existence of a firm is to maximize the wealth of its shareholders, whereas funds directed towards environmental and social undertakings unnecessarily increase their operating cost thus leading to reduced profitability. Contrarily, stakeholder theory offers an entirely different paradigm and suggests that besides corporate owners, other stakeholders are equally imperative for more beneficial contracting opening up new opportunities for economic growth and stability (Freeman, 1984, Jones, 1995). Similarly, Porter claims that if firms can effectively demonstrate that their environmental performance can develop a favorable social image leading to beneficial contracting in the market reducing their costs, increasing market share, and creating shared value (Porter & Linde, 1995). Moreover, environmental regulations encourage companies to look for more innovative and green manufacturing and value chain solutions to help lower their costs and optimize environmental as well as economic performance. Such an integrated corporate performance that takes care of the firm's economic and social responsibility is what entails the legitimacy theory, which postulates that an organization's right to operate is granted by its surrounding environment as a social contract that must be continuously reaffirmed (Scherer and Palazzo, 2007).

2.1. Environmental investment and corporate performance

Corporate social responsibility (CSR) is a well-known concept that influences various performance fundamentals of a firm (Yang et al., 2019). However, the focus of research has now shifted from the aggregate concept to individual CSR dimensions, especially the environmental aspect has arrested considerable attention in the backdrop of worldwide climate change issues and environmental degradation (Flammer, 2013, Li et al., 2017). The extant studies indicate mixed empirical outcomes on the association between environmental performance and corporate financial performance (CFP). A systematic review of literature by (Horváthová, 2010) reveals that 55 percent of the studies found a positive association, while 30 percent found a negative association, and 15 percent found no association between environmental performance and CFP. A recent survey of 2000 empirical studies and several review articles found that the association between corporate social performance and CFP is well established; and nearly 90% of the studies revealed a non-negative association while a vast majority of the researches show a positive association on this relation (Friede et al., 2015). More recently, a systematic literature review on the association between the environmental, social, and governance (ESG) and CFP found a significant positive yet economically modest association wherein this association was stronger between environmental aspect and CFP (Huang, 2019). In the European context, a recent study finds a significant positive impact of ESG on firm value (Qureshi, Kirkerud, Theresa, & Ahsan, 2020). Empirical evidence from the US suggests that a higher green rank of the firms is associated with better performance in the stock market (Yadav et al., 2016; Surroca et al., 2010). In China, good environmental performance can bolster firms' operating profitability and stock market performance (Cai and He, 2014; Wong et al., 2018; Zhou and Yin, 2018). Further, the investors in China penalize the firms that display irresponsible behavior towards the environment (Flammer, 2013; Zhou and Yin, 2018). As such, we propose our first hypothesis as follows:

H1

Environment protection investment by firms has a positive effect on their financial performance

2.2. Environmental investment and financial constraints

The literature on financial constraints suggests that a firm's investment behavior is a function of its expected future profitability (Khan et al., 2016). Firms have scarce financial resources which they want to allocate to value-maximizing projects to optimize their investment efficiency (Ahmed et al., 2019). A World Bank survey of Chinese companies for 2011-13 observed that although minor financial constraints do not significantly affect their environmental performance, however, moderate and major financing impediments considerably attenuate corporate environmental performance due to higher financing costs and unfavorable policy incentives (Tian and Lin, 2019). A recent study found that financial constraints significantly hamper a firm's ability to undertake environmental protection investments; and this relationship is more pronounced in privately owned firms and foreign firms due to their limited ability to obtain funds through external sources whereas state-owned firms can easily alleviate financing pressure by borrowing from financial institutions (Zhang et al., 2019). However, some observed a decline in stock price after a firm won the award on superior environmental performance in China (Lyon et al., 2013), and others found that government disclosures on environmental misconduct did not significantly influence the stock price of such firms (Xu et al., 2012). Financially constrained firms rely on internal cash flows to finance their investment endeavors (Fazzari et al., 1987). With a limited financial resource, such firms prioritize investments to optimize their financial performance. As environmental investments, usually have a limited impact on corporate performance in the short-term and have expected long-term impact, the managers of financially constrained firms favor short-term and tend to prioritize non-environment investment over environmental investments that may yield relatively early higher expected return (Guariglia and Liu, 2014). Therefore, financially constrained firms would only undertake essential environmental investments in order to comply with the governmental regulations that potentially leave them with fewer resources to undertake financially attractive investment alternatives. Consequently, financial performance of financially constrained firms may decline. Hence, it is plausible to believe that the positive association between environmental investment and firm performance is not a universal phenomenon and it only holds for the firms with better financial standing. We put forward our second hypothesis as follows.

H2

Environment protection investment by financially non-constrained (constrained) firms has a positive (negative) effect on their financial performance

3. Empirical Model, Method, And Data Description

3.1 Empirical model

To explore the impact of environmental protection investment on firm performance under the situation of financing constraints, this paper constructs the following regression model and divides the sample into two groups according to the level of financial constraints that a firm face to do the GMM regression:

$$CFP_{it} = \beta_0 + \beta_1 EINV_{it} + \beta_2 CNT_{it} + \beta_3 GOV_{it} + \mu_{it} + \varepsilon_{it} + \varepsilon_{it} \dots \dots \dots (1)$$

where CFP_{it} is one of the two measures of corporate financial performance i.e. market performance TQ_{it} and accounting financial performance ROA_{it} and; $EINV_{it}$ is one of the two measures of a firm's environmental investment: first, the ratio of the total amount of environmental investment multiplied by 100 divided by total assets ($EINV1_{it}$), and second, the natural logarithm of the total environmental protection investment+1 ($EINV2_{it}$); CNT_{it} represents five firm-level financial controls i.e. $SIZE_{it}$ natural logarithm of total assets of the firm, LEV_{it} is total debt over total assets, GR_{it} is percentage growth in total assets, $CASH_{it}$ is cash and cash equivalents over total assets, and TAN_{it} is total fixed assets over total assets; and GOV_{it} represents firm-level governance variables i.e. CTL_{it} percentage shares held by largest shareholder, $DUAL_{it}$ proxy for chairman-CEO duality, IND_{it} percentage of independent directors on board, and ST_{it} proxy for the state-owned firm.

Table 1 provides definitions of all variables included in our empirical model.

3.2 Measurement of financial constraints

We construct a dummy variable of corporate financing constraints following Kaplan and Zingales (1997) and He and Ye (2017) to classify the sample firms as financially constrained and non-constrained firms. The calculation methodology is as follows. As a first step, we calculate five different ratios for each year: i. cash flow from operating activities over total assets (CFOA), ii. cash dividends over total assets (CD), iii. cash and cash equivalents over total assets (Cash & Kilcullen), iv. total debt over total assets (Levy & Murnane), v. Tobin's Q as market value to total equity plus book value of total debt over book value of total assets (TQ). In the second step, we assign 1 or zero values to dummy variables kz_1 to kz_5 for each year. If CFOA is less than the median, then kz_1 will assume value 1 otherwise zero. If CD is less than the median, then kz_2 will assume value 1 otherwise zero. If Cash is less than the median, then kz_3 will assume value 1 otherwise zero. If Lev is greater than the median, then kz_4 will assume value 1 otherwise zero. If TQ is greater than the median, then kz_5 will assume value 1 otherwise zero. In the third step, we add up the values of kz_1 to kz_5 to make $KZ = kz_1 + kz_2 + kz_3 + kz_4 + kz_5$. In the fourth step, we take KZ as the dependent variable and use the ordered logit model to regress the five ratios calculated in the first step to get the regression coefficient of each variable. In the fifth step, we use the value of each ratio and the regression coefficient of each ratio we sum up the KZ index to measure the degree of financing constraints of listed companies. The larger the KZ index, the stronger the financing constraints of listed companies. After getting the KZ index, we calculate a dummy variable that equals 1 if KZ value is less than the mean value otherwise it equals 0 and uses it as a grouping purpose. This whole procedure divides our sample of 1988 firms into 817 financially non-constrained firms and 1171 financially constrained firms.

3.3 Method

To mitigate the risk of obtaining biased results, we employ panel-based two-step system GMM technique considered as the most efficient method to address the issues of unobserved heterogeneity, endogeneity, and heteroskedasticity in the panel data (Hsiao, 1985; Abuzayed, 2012; Baños-Caballero et al., 2014; Tahir and Anuar, 2016). Moreover, two-step system GMM based models require only two diagnostics: Hansen test for over-identification restrictions to test the validity of instruments and AR2 to test the assumption that the differenced error terms do not have a second-order serial correlation. The reported results under each regression model and the p-values of Hansen test and AR2 are insignificant in all cases suggesting that the instruments are valid and the results do not suffer due to auto-correlation.

3.4 Data description

The data of this study is composed of 1988 Chinese firms listed on Shanghai and Shenzhen stock exchanges during 2009-2016. We extracted environmental investment data manually from the CSR report of each firm. Moreover, data of all the other variables of sample firms was obtained from the CSMAR[1] (China Stock Market & Accounting Research) database.

Table 2 reports the descriptive statistics of the variables. With a mean of 1.628 and a standard deviation (SD) of 1.396, the sampled firms have a lot of variation in their market performance and 50% of the sampled firms have market performance below the mean value. Similarly, the operating performance of the sampled firms shows that the performance of different firms is quite different (with a mean of 0.026 and SD of 0.053). A wide range of book financial performance and market performance plausibly indicates the potential impact of environmental protection investment under financing constraint situation that calls for an investigation. The mean value of the two environmental investment variables is 2.027 and 1.670 respectively, and the range of each variable is relatively large, which shows that different firms have different environmental investment preferences. The values of control variables are generally consistent with the previous literature (Jiang & Akbar, 2018; Wang et al., 2020).

Table 3 reports the correlation among the variables. Quite intuitively, there is a positive correlation between TQ and ROA, and between the two environmental protection investment variables. To avoid multicollinearity in regression analysis, we use two environmental protection investment variables separately in two different models. The correlation coefficients among all other variables are relatively small and below 0.5, which means the regression model will not produce serious multicollinearity problems. Further, we calculate the variation inflation factor (VIF) and a VIF of less than 10 for all of our regression models suggests that our models are robust for multicollinearity (Ott & Longnecker, 2015).

Footnote:

[1] <https://cn.gtadata.com>

4. Results And Discussion

We report the results of our model (Eq. 1) for market performance (TQ_{it}) in Table 4 and operating performance (ROA_{it}) in Table 5. In both tables, the first and third columns are regression results of financially non-constrained sample firms, and the second and fourth columns are regression results of financing constraint sample firms.

Results in Table 4 explain that a higher rate (as a percentage of their total assets) of environmental protection investment ($EINV1_{it}$) of financially non-constrained firms significantly increases their market performance, whereas the market performance of financially constrained firms significantly diminishes as a result of higher environmental protection investment. This finding suggests that the market encourages (discourages) a higher rate of environmental protection investment by financially non-constrained (constrained) firms indicating the market's preference for stakeholders' theory (shareholders' theory) for these firms. In other words, if the firm were not financially constrained, the market would encourage a higher rate of corporate investment to protect the environment. However, the same market would discourage a higher rate of environmental investment if the firms were financially constrained. This very interesting finding suggests that along with environmental regulations and compulsive compliance to protect the environment, the policymakers in China need to consider out-of-box solutions and provide enabling financial environment to the firms and provide financial flexibility to financially constrained firms to optimize their contribution towards environmental preservation. Consequently, managers of financially constrained firms pursuing rather exclusive shareholders' theory would be motivated to follow inclusive stakeholders' theory if such firms attain financial flexibility and hence increase the rate of their environmental investment. Nevertheless, it is interesting to note that the market not only encourages the higher rate of environmental investment by non-constrained firms but also total environmental investment ($EINV2_{it}$) has a relatively higher impact on the market performance of non-constrained firms. Further, firm size, leverage, growth, tangibility hurts the environmental investment of both types of firms. Our results about leverage and growth are in line with earlier studies but the results for firm size are contradictory (Jiang & Akbar, 2018; Yang et al., 2019). A potential explanation may be that bigger firms in the West are more visible in the public eye and to maintain a better image in the public they invest relatively more in their efforts to protect the environment. Whereas in China bigger firms have relatively stronger ties with public officeholders that may allow such firms to get away with their fair share of environmental responsibility. Quite intuitively, the market considers higher cash as value additive in non-constrained firms but considers it as idle cash and value decreasing in financially constrained firms. It is interesting to note that a higher percentage of shares held by the large shareholder reduces the value of non-constrained firms whereas it adds value to the financially constrained firms. This plausibly indicates that the investors in the market consider large shareholders as valuable network resources that could enable the firm to engage in cost-effective transactions in financial and other markets. Further, power concentration in chairman-CEO duality is also considered value decreasing by the market players. Moreover, a higher percentage of independent directors adds value to the non-constrained firms and destroy value for the financially constrained firms. Furthermore, the market considers the increased role of the state in corporate ownership as value decreasing.

Results in Table 5 explain that a higher rate (as a percentage of their total assets) of environmental protection investment of both types ($EINV1_{it}$, $EINV2_{it}$) improves the accounting performance of non-constrained firms only whereas these investments have a significant negative impact on the financial performance of financially constrained firms as measured by ROA. This finding clearly suggests a positive impact on the accounting-based financial performance of non-constrained firms. A plausible explanation is that these environmental protection investments are potentially made in greener production and green value chains that not only reduce the production and operational costs to improve accounting-based financial performance but also help protect the environment. This exciting finding reinforces our earlier assertion that urges Chinese policymakers to provide an enabling financial environment ensuring financial flexibility for them. This shall enable their managers to focus on complex environmental problems as compared to rather simple and manageable financial problems. Though a negative association between corporate environmental investment and profitability of financially constrained firms is justified on the ground that such firms are already facing challenges to finance their operations. Thus additional obligations to commit funds to environmental protection limit their ability to undertake profitable investment opportunities. Hence, the policymakers shall offer more financial space and favorable policies to such firms to alleviate the adverse effects of financial constraints to optimize their role towards pollution abatement.

Similar to TQ_{it} , higher leverage hurts ROA_{it} and higher growth contributes to increased profitability. Contrary to our findings for TQ_{it} , a higher percentage of shares held by the large shareholder and power concentration in chairman-CEO duality improve accounting-based financial performance non-constrained firms only whereas conforming our results for TQ_{it} , higher percentage of independent directors negatively affect ROA_{it} . Finally, the increased role of the state in corporate ownership and consequent inefficiencies decrease the accounting-based financial performance of the firms.

4.1 Robustness

To ensure robustness, we used both accounting performance measure (ROA) and market performance measure (TQ) and the results are consistent in both cases. The use of accounting-based performance measure reflects the impact of environmental investment on the profitability of sample firms. While, the market proxy of corporate performance unveils the investors' response to a firms' environmental investment in the stock market. Similarly, we have used two proxies for environmental investment in each regression analysis and our baseline results remain unchanged.

5. Conclusions And Policy Implications

The corporate sector is a major source of pollution emissions in China. Recent strict policy measures adopted by the Chinese government require firms to deploy financial resources for pollution abatement, greener production, and environmental protection. Consequently, Chinese firms feel compelled to comply with relatively stricter environmental regulations that may lead to the increased cost of doing business. However, this may not lead to a sustainable path of environmental conservation. To understand the nexus between corporate environmental protection investment and corporate financial performance, we collected the data of 1,988 firms over the period of 2009–2016. Results reveal the moderating influence of financial constraints in pollution abatement, and corporate environmental protection investments to affect the accounting and market performance of Chinese listed firms. Results explain that higher environmental protection investment of financially non-constrained firms significantly increases their market performance as well as accounting-based

financial performance. These results clearly suggest that the Chinese investors appreciate the necessity of making the environmental investment to curtail emissions and protect the ecosystem. However, we obtained opposite results for financially constrained firms. The environmental protection investment of these firms has a significant negative affect on their accounting-based financial performance. Likewise, the market discourages a higher rate of environmental investment as a percentage of total assets. Faced with a trade-off, financially constrained firms prioritize business investment over environmental investment because environmental investments do not significantly contribute to the accounting-based financial performance of these firms. Therefore, we argue that along with environmental regulations and compulsive compliance to protect the environment, the policymakers in China need to integrate corporate financial flexibility and economic benefits into their environmental protection regime to motivate financially constrained firms pursuing rather exclusive shareholders' theory to follow inclusive stakeholders' theory. Further, it is strange to note that bigger firms that otherwise have more resource size make a lesser environmental investment as a percentage of their assets plausibly due to relatively stronger ties with public officeholders that may allow the firms to get away with their fair share of environmental responsibility. The policy implication of this result for the Chinese government is to improve its governance and monitoring mechanism to mitigate the negative effect of such networking commonly known as guanxi. Therefore, at a policy level along with a stringent regulatory framework, the regulators in China need to integrate financial flexibility and mitigation of the negative impact of guanxi (corporate networking) into corporate environmental performance so that the Chinese firms voluntarily make environmental investments for greener production to help conserve the environment as well as create value for their stakeholders including their shareholders.

Declarations

Ethics approval and consent to participate

Not Applicable

Consent for publication

Not applicable

Availability of data and materials

Dataset, analysis file, and codes are available upon request.

Competing interests

The authors declare that they have no competing interests

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Authors' contributions

AA conceptualized the idea and wrote the manuscript. XJ performed data analysis and interpretation. MA & MAQ performed review and editing. All authors read and approved the final manuscript.

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Tables

Table 1: Variable name and description

Variable	Abbreviation	Definition
Dependent Variables		
Market Performance	TQ_{it}	Market value of firm's equity plus book value of debt / Total assets
Financial Performance	ROA_{it}	Firm's net income before tax / Total assets
Independent Variables		
Environment Investment ₁	$EINV1_{it}$	100×Total environmental protection investment / last year's total assets
Environment Investment ₂	$EINV2_{it}$	The natural logarithm of the total environmental protection investment+1
Control Variables		
Firm Size	$SIZE_{it}$	Natural logarithm of the total assets
Leverage	LEV_{it}	Total debt / Total assets
Growth	GR_{it}	(Total assets _t - Total assets _{t-1}) / Total assets _{t-1}
Cash	$CASH_{it}$	Cash and cash equivalents / Total assets
Tangibility	TAN_{it}	Total fixed assets / Total assets
Control	CTL_{it}	Percentage of shares held by the largest shareholder
Duality	$DUAL_{it}$	Duality dummy: 1 if chairman and CEO are the same person, otherwise 0
Independent Directors	IND_{it}	Percentage of independent directors on the board
State	ST_{it}	State dummy: 1 if the firm is state-owned, otherwise 0

Table 2: Descriptive statistics

Variable	N	Mean	SD	Min	Median	Max
TQ_{it}	1,988	1.628	1.396	0.207	1.262	12.408
ROA_{it}	1,988	0.026	0.053	-0.272	0.024	0.197
$EINV1_{it}$	1,988	2.027	4.070	0.001	0.492	26.524
$EINV2_{it}$	1,988	1.670	1.453	0.002	1.296	5.516
$SIZE_{it}$	1,988	22.610	1.224	19.503	22.492	25.622
LEV_{it}	1,988	0.533	0.191	0.055	0.547	1.210
GR_{it}	1,988	0.282	0.961	-0.830	0.092	11.464
$CASH_{it}$	1,988	0.134	0.086	0.006	0.117	0.611
TAN_{it}	1,988	0.332	0.181	0.002	0.315	0.856
CTL_{it}	1,988	0.369	0.154	0.090	0.355	0.750
$DUAL_{it}$	1,988	0.175	0.380	0.000	0.000	1.000
IND_{it}	1,988	0.367	0.052	0.231	0.333	0.667
ST_{it}	1,988	0.632	0.482	0.000	1.000	1.000

Table 3: Correlation Matrix

	TQ_{it}	ROA_{it}	$EINV1_{it}$	$EINV2_{it}$	$SIZE_{it}$	LEV_{it}	GR_{it}	$CASH_{it}$	TAN_{it}	CTL_{it}	$DUAL_{it}$	IND_{it}
TQ_{it}	1											
ROA_{it}	0.196***	1										
$EINV1_{it}$	0.027	0.017	1									
$EINV2_{it}$	-0.267***	-0.009	0.598***	1								
$SIZE_{it}$	-0.494***	0.048***	-0.057***	0.488***	1							
LEV_{it}	-0.481***	-0.404***	0.001	0.229***	0.403***	1						
GR_{it}	0.033*	0.014	0.006	-0.048***	-0.012	0.037**	1					
$CASH_{it}$	0.195***	0.224***	0.008	-0.143***	-0.138***	-0.318***	-0.007	1				
TAN_{it}	-0.242***	-0.187***	0.019	0.239***	0.131***	0.178***	-0.115***	-0.433***	1			
CTL_{it}	-0.164***	0.037**	-0.030*	0.122***	0.310***	0.114***	-0.004	-0.073***	0.100***	1		
$DUAL_{it}$	0.117***	0.015	0.120***	-0.014	-0.163***	-0.097***	0.020	0.055***	-0.030*	-0.133***	1	
IND_{it}	0.036**	0.028	-0.013	-0.040**	0.053***	-0.040**	-0.019	0.040**	-0.082***	0.076***	0.030*	1
ST_{it}	-0.253***	-0.086***	-0.133***	0.065***	0.307***	0.283***	0.029*	-0.115***	0.228***	0.246***	-0.275***	-0.039*

Table 4: Impact of environmental investment on market performance (TQ_{it})

	(1)	(2)	(3)	(4)
	Non-constrained	Constrained	Non-constrained	Constrained
<i>EINV1_{it}</i>	0.022 ^{***}	-0.008 ^{***}		
	(7.77)	(-2.73)		
<i>EINV2_{it}</i>			0.110 ^{***}	0.055 ^{***}
			(7.63)	(3.29)
<i>SIZE_{it}</i>	-0.775 ^{***}	-0.669 ^{***}	-0.933 ^{***}	-0.831 ^{***}
	(-13.76)	(-6.07)	(-13.16)	(-8.19)
<i>LEV_{it}</i>	-0.372 ^{**}	-1.203 ^{***}	-0.644 ^{***}	-1.104 ^{***}
	(-2.39)	(-5.67)	(-3.87)	(-4.84)
<i>GR_{it}</i>	-0.067 ^{***}	-0.020 ^{***}	-0.060 ^{***}	-0.019 ^{***}
	(-7.14)	(-2.80)	(-5.06)	(-2.65)
<i>CASH_{it}</i>	0.535 ^{***}	-0.941 ^{***}	0.557 ^{***}	-0.699 ^{**}
	(2.94)	(-3.66)	(2.79)	(-2.54)
<i>TAN_{it}</i>	-0.175	-0.745 ^{***}	-0.620 ^{***}	-0.582 ^{***}
	(-1.10)	(-3.64)	(-3.49)	(-2.58)
<i>CTL_{it}</i>	-1.321 ^{***}	1.765 ^{***}	-1.196 ^{***}	1.826 ^{***}
	(-4.85)	(3.66)	(-3.92)	(3.56)
<i>DUAL_{it}</i>	-0.157 ^{***}	-0.314 ^{***}	-0.212 ^{***}	-0.245 ^{***}
	(-2.67)	(-3.94)	(-3.43)	(-2.95)
<i>IND_{it}</i>	0.477	-2.042 ^{***}	0.044	-2.178 ^{***}
	(1.53)	(-4.33)	(0.12)	(-4.56)
<i>ST_{it}</i>	-0.692 ^{**}	-0.663 ^{***}	-0.525 [*]	-0.741 ^{***}
	(-2.18)	(-3.44)	(-1.72)	(-4.08)
Year Effect	YES	YES	YES	YES
Industry Effect	YES	YES	YES	YES
<i>N</i>	817	1,171	817	1,171
<i>ar2</i>	-1.220	0.884	-1.413	0.882
<i>ar2p</i>	0.223	0.377	0.158	0.378
<i>hansen</i>	219.313	220.904	212.755	216.871
<i>hansen_df</i>	192.000	192.000	192.000	192.000
<i>hansenp</i>	0.086	0.075	0.145	0.105

t statistics in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 5: Impact of environmental investment on accounting performance (ROA_{it})

	(1)	(2)	(3)	(4)
	Non-constrained	Constrained	Non-constrained	Constrained
<i>EINV1_{it}</i>	0.001***	-0.000		
	(9.78)	(-0.74)		
<i>EINV2_{it}</i>			0.008***	-0.000
			(11.87)	(-0.49)
<i>SIZE_{it}</i>	-0.017***	0.050***	-0.017***	0.054***
	(-6.76)	(9.48)	(-6.07)	(9.88)
<i>LEV_{it}</i>	-0.139***	-0.207***	-0.149***	-0.220***
	(-13.51)	(-17.33)	(-14.03)	(-18.63)
<i>GR_{it}</i>	0.002***	0.003***	0.002**	0.003***
	(3.16)	(9.47)	(2.28)	(10.03)
<i>CASH_{it}</i>	-0.004	0.029*	-0.000	0.025
	(-0.37)	(1.84)	(-0.01)	(1.48)
<i>TAN_{it}</i>	-0.020**	-0.099***	-0.026**	-0.099***
	(-2.12)	(-6.10)	(-2.33)	(-6.65)
<i>CTL_{it}</i>	0.044**	0.028	0.033*	0.018
	(2.40)	(0.94)	(1.79)	(0.58)
<i>DUAL_{it}</i>	0.013***	0.004	0.012***	0.005
	(4.47)	(1.03)	(3.40)	(1.24)
<i>IND_{it}</i>	-0.017	-0.117***	0.014	-0.099***
	(-1.01)	(-4.34)	(0.79)	(-3.70)
<i>ST_{it}</i>	-0.038***	-0.040***	-0.036***	-0.037***
	(-4.83)	(-3.20)	(-4.49)	(-2.70)
Year Effect	YES	YES	YES	YES
Industry Effect	YES	YES	YES	YES
<i>N</i>	817	1,171	817	1,171
ar2	-1.632	-0.468	-1.642	-0.418
ar2p	0.103	0.640	0.101	0.676
hansen	185.867	200.195	186.053	199.620
hansen_df	192.000	192.000	192.000	192.000
hansenp	0.611	0.328	0.607	0.338

t statistics in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$